

# MULTIDISCIPLINARY WATER-QUALITY ASSESSMENT

## Mission

The Multidisciplinary Water-Quality Assessment Team conducts studies of the physical, chemical, and biological components of hydrologic systems. Investigations focus on water-quality issues, utilize new technologies and techniques, and are conducted over a wide range of spatial and temporal scales. The goal of the team is to understand the interactions among components of hydrologic systems and their relations to water quality in order to enhance the management of water resources.



## Team Members

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# INTERAGENCY METHODS AND DATA COMPARABILITY BOARD (MDCB)

**COOPERATOR:**

U.S. Geological Survey

**PROJECT CHIEF:**

Charles A. Peters

**LOCATION:**

Comprised of individuals from throughout the United States

**PROJECT NUMBER:**

WI 00303

**PERIOD OF PROJECT:**

April 1998 to April 2003

**PROBLEM**

Significant resources are spent to monitor water quality in the United States. The methods used to collect water samples and to analyze the samples collected vary between the collecting authority. The data obtained using the various methods may not be comparable and therefore monitoring entities may collect duplicate data.

**OBJECTIVE**

A nationwide partnership of water-monitoring authorities from Federal and State agencies, tribes, municipalities, business and industry, academia, and others with expertise in environmental monitoring has been assembled to coordinate and provide guidance for implementation of a voluntary, integrated, nationwide monitoring strategy that will provide comparable data.

**APPROACH**

The MDCB holds quarterly meetings to discuss the progress and plans of work groups formed to develop

consensus positions regarding issues related to sampling and analytical approaches. The eight work groups (Performance Based Systems, National Environmental Methods Index, Laboratory Accreditation and Field Certification, Biological Methods, Nutrient Methods, Water Quality Data Elements, New Technologies, and Publicity and Outreach) establish work plans and meet via conference calls and at the quarterly MDCB meetings to accomplish work plan objectives.

**PROGRESS (July 2001 to June 2002)**

The USGS Methods Board co-chair is responsible for maintaining a public and internal board website, developing work plans, organizing meetings and conference calls, preparing meeting minutes, assisting with the preparation of position papers and pilot studies, preparing outreach products, and providing guidance for and participating in other MDCB activities. The co-chair also participates as a member of the National Water Quality Monitoring Council (NWQMC), as a member of the NWQMC steering committee, and as a co-chair for the National Monitoring Conferences.

## PLANS (July 2002 to April 2003)

The co-chair will continue to maintain a public website, develop work plans, organize meetings and conference calls, prepare meeting minutes, assist with the preparation of position papers and pilot studies, prepare outreach products, and provide guidance for and participate in other MDCB activities. The co-chair also participates as a member of the National Water Quality Monitoring Council (NWQMC), and as a member of the NWQMC steering committee.

## REPORTS

- MDCB, 1998, National Methods and Data Comparability Board: Collaboration and Comparability, Fact Sheet.
- Eaton, A. and J. Diamond, 1999, Reservoir Dogs and Performance Based Systems, Environmental Testing and Analysis, May/June 1999.
- Brass, H., Spooner, C., Klein, J.M., Shockey, M., 1999, Objectives and Activities of the National Water Quality Monitoring Council, International Conference of the Israel Society for Ecology and Environmental Quality Sciences, Jerusalem, Israel, June, 1999.
- Diamond, J., Stribling, S., Yoder, C., 1998, Determining the Comparability of Bio-assessment Methods and Their Results, NWQMC National Monitoring Conference 1998, Reno, NV, July, 1998.
- Strong, A., 1998, Performance Based Methods Systems, NWQMC National Monitoring Conference 1998, Reno, NV, July, 1998.
- Eaton, A. 1999, Performance Based Systems (PBMS)- the Methods and Data Comparability Board Approach, 15th Annual WTQA Conference, Washington, DC July, 1999.
- Brass, H., 1999, The Methods and Data Comparability Board: Collaboration and Comparability, American

Water Works Association - Water Quality Technology Conference., Tampa, FL, November, 1999.

- Eaton, A., Diamond, J., Annis, C., Strong, A., McChesney, D., Brass, H., Shockey, M., 1999, Reservoir Dogs and Performance Based Systems for the Analysis of Environmental Contaminants, American Water Works Association - Water Quality Technology Conference, Tampa, FL, November 1999.
- MDCB, 2000, Why is a National Environmental Methods Index Needed?, Fact Sheet.
- Parr, J., 2000, Determining and Documenting the Suitability of Analytical Procedures Used for Analysis of Environmental Samples, NWQMC National Monitoring Conference 2000, Austin, TX, April 2000.
- Peters, C., Brass, H., Diamond, J., 2001, United States Water Quality Methods and Data Comparability Board: Creating a Framework for Collaboration and Comparability, Monitoring Tailor Made III, Nunspeet, Netherlands, September, 2000.
- Brass, H., Ardourel, H., Diamond, J., Eaton, A., Keith, L., Peters, C., 2000, Activities of the Interagency Methods and Data Comparability Board, American Water Works Association - Water Quality Technology Conference, Salt Lake City, Utah, November 2000.
- Diamond, J., Eaton, A., Annis, C., Brass, H., Keith, L., Strong, A., McChesney, D., Shockey, M., 2001, Towards a Definition of Performance-Based Laboratory Methods, National Water Quality Monitoring Council Technical Report 01-02.
- Keith, L., Sullivan, D., Boiani, J., Brass, H., Peters, C., 2001, The National Environmental Methods Index as a Tool to Achieve Methods Comparability, American Water Works Association-Water Quality Technology Conference, Nashville, TN, November, 2001.
- MDCB, 2001, National Methods and data Comparability Board: Collaboration and Comparability, Fact Sheet.

# ONEIDA NATION HYDROLOGIC INVESTIGATIONS

**COOPERATOR:**

Oneida Nation of Wisconsin

**PROJECT CHIEF:**

Kevin D. Richards

**LOCATION:**

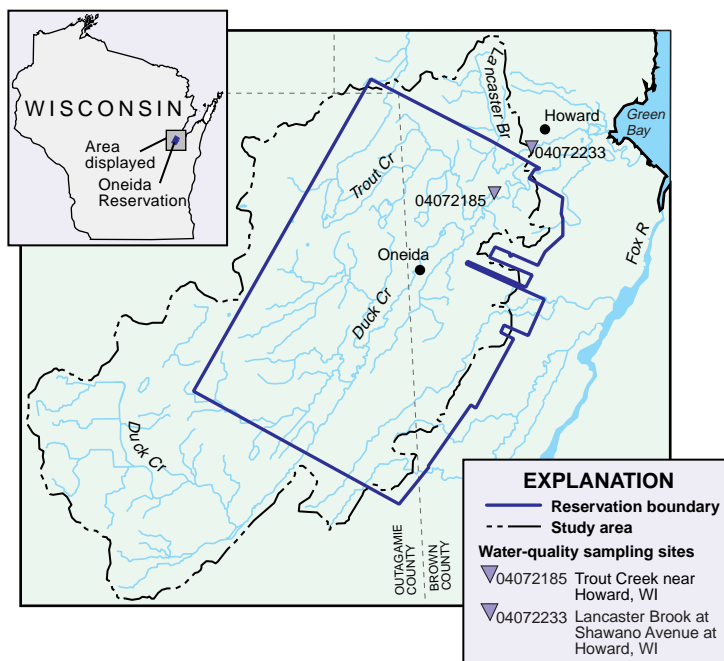
Oneida Indian Reservation

**PROJECT NUMBER:**

WI 12306

**PERIOD OF PROJECT:**

August 1997 to September 2003

**PROBLEM**

The Oneida Nation in Wisconsin has developed a seven-generation plan for their reservation that includes instituting land-use practices that will allow the surface-water system draining the reservation the opportunity to revert to its pre-colonial condition. The Oneida Nation needs continuing information regarding water-quality conditions entering and within their Nation's boundaries. The information is needed to determine trends in water quality and provide data to assess the Tribe's water resources.

**OBJECTIVE**

The objective is to collect long-term data at two sites to perform trend analysis for pesticides, nutrients and suspended sediment.

**APPROACH**

Sampling will be conducted at two sites to determine concentrations of nutrients, pesticides, and suspended sediment. Field parameters will also be collected and sampling will take place on a fixed interval. The National Water Quality Lab will do the analysis of the water samples. National Water-Quality Assess-

ment protocols will be followed in the collection and handling of the water-column samples. A staff person from the Oneida Nation Environmental Section will work with a USGS staff person in the collection of data.

**PROGRESS (July 2001 to June 2002)**

Samples were collected at two sites monthly plus four events. Samples were analyzed for pesticides, nutrients and suspended-sediment concentrations. Data collected in 2001 were published in the report, "Water Resources Data-Wisconsin, Water Year 2001."

**PLANS (July 2002 to June 2003)**

Data from samples collected from October 1, 2002 through September 30, 2003, will be published in the report, "Water Resources Data-Wisconsin, Water Year 2001." Water-quality sampling will be conducted at two sites and continue indefinitely.

**REPORTS**

Schmidt, M.A., Richards, K.D. and Scudder, B.C., 2000, Surface-water quality, Oneida Reservation and vicinity, Wisconsin, 1997-98, U.S. Geological Survey Water-Resources Investigations Report 00-4179, 30 p.

# THE SURFACE WATER RESOURCES OF THE HO-CHUNK TRIBE

**COOPERATOR:**

Ho-Chunk Nation of Wisconsin

**PROJECT CHIEF:**

Daniel J. Sullivan

**LOCATION:**

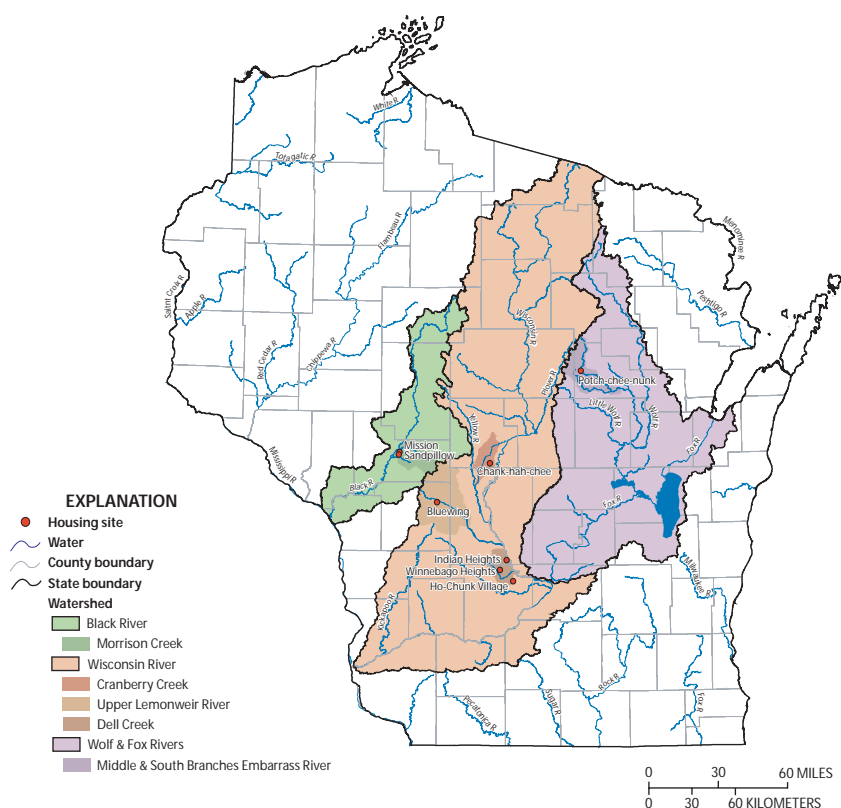
Jackson, Sauk, Monroe, Juneau,  
Wood, and Shawano Counties

**PROJECT NUMBER:**

WI 12311

**PERIOD OF PROJECT:**

September 2000–Continuing

**PROBLEM**

The Ho-Chunk Nation is concerned about the condition of streams and rivers on and around their residential lands because tribal members use these waters for food and recreation. Information regarding these waters is scarce and no summary of information is available.

**OBJECTIVE**

The objective is to provide the Nation with information about their surface water resources that will allow them to: (1) make decisions about using these waters for food and recreation, and (2) initiate a monitoring program for important waters.

**APPROACH**

Information on physical, chemical and biological characteristics of streams within a one-mile radius of Ho-Chunk residential lands will be collected through a

literature and database search and summarized in a retrospective report. This summary will provide a basis for designing a sampling plan that will be carried out on selected streams to augment historical information.

**PROGRESS (July 2001 to June 2002)**

Preparation of the retrospective report continues. A sampling plan for 2002 is complete.

**PLANS (July 2002 to June 2003)**

The retrospective report is planned as a Water Resources Investigations report. Water quality and fish and invertebrate communities will be sampled during the period of May–September, 2002. A report, summarizing and analyzing the results of these surveys, is planned for FY2003.

# WESTERN LAKE MICHIGAN DRAINAGES NATIONAL WATER-QUALITY ASSESSMENT (NAWQA)

**COOPERATOR:**

U.S. Geological Survey,  
Reston, Virginia

**LOCATIONS:**

Upper peninsula of Michigan from the Menominee River basin in the west to the Fishdam River basin in the east; and the eastern portion of Wisconsin to include the Menominee, Oconto, Peshtigo, Fox-Wolf River basins discharging to Green Bay, and in Wisconsin that directly drain into Lake Michigan from the west which include the Manitowoc, Sheboygan, Milwaukee, Root, and Pike River basins.

**PROJECT NUMBER:**

WI 17400

**PROJECT CHIEF:**

Charles A. Peters

**PERIOD OF PROJECT:**

December 1990–Continuing

**PROBLEM**

Growing populations throughout the United States have resulted in increased development and use of our water resources. As our water resources become stressed, decisions on how to effectively utilize and manage these resources will need to be made. These decisions must be based on accurate assessments of the quality of the water resource and the factors affecting its quality.

**OBJECTIVE**

The long-term goals of the NAWQA project are to determine the water quality of the streams and aquifers in the Western Lake Michigan Drainages (WMIC),

determine the presence or absence of any trends in the water quality, and provide an understanding of the link between natural and anthropogenic factors and observed water quality.

**APPROACH**

Western lake Michigan Drainages study unit investigations will be conducted in 10-year cycles. Cycle 1 took place between 1991 and 2000 and consisted of a retrospective analyses of existing water quality (1991–1993), high intensity phase data collection (1993–1995), data analyses and report writing (1995–1997), and low-intensity phase data collection (1996–2000). Cycle 2 began with a planning and retrospective data analyses phase (2000–2001) and will be



followed by high-intensity phase data collection (2001–2003), topical study data collection (2002–2004), data analyses and report writing (2003–2006), and low intensity phase data collection (2004–2010).

These types of studies will be conducted as part of the Western Lake Michigan Drainages study unit investigation: (1) occurrence and distribution assessments; (2) trends assessments; and (3) topical studies.

The surface water occurrence and distribution and trends assessment networks were developed by identifying relatively homogeneous areas of specific land use and environmental characteristics. Sampling sites were chosen to assess watersheds representing a single relatively homogeneous unit (RHU) or watersheds defined by several RHUs. Sites sampling a single RHU were called indicator sites and those sampling several RHUs were termed integrator sites.

The ground water sampling networks were designed to assess the primarily used aquifers in the study unit: the Cambrian-Ordovician Sandstone and the glacial outwash aquifer systems, and also to assess the effect of various land uses on shallow ground water.

## **PROGRESS CYCLE 1 (1991–2000)**

Eleven basic-fixed sites (BFS) were sampled during the cycle 1 high-intensity sampling phase (HIP), 8 indicator sites and 3 integrator sites. The sites were sampled monthly and augmented with seasonal storm sampling for major ions, nutrients, organic contaminants, trace elements, suspended sediments, and pesticides during the HIP. Several agricultural and urban land use indicator sites were also sampled more intensively for pesticides during the growing season. The eleven BFS were also assessed for habitat and sampled for fish, macro-invertebrate, and algae annually during the HIP.

The ground water occurrence and distribution assessment networks were developed around major aquifers in the study unit. During cycle 1, twenty-nine wells in the Cambrian-Ordovician aquifer system were sampled for major ions, nutrients, VOCs, trace elements, radon, tritium, DOC, and pesticides. The shallow ground water land use networks studied the effect of surficial deposits (clayey or sandy) in agricultural areas on water quality.

Streambed sediments and tissue from aquatic biota were sampled at each of the fixed sites and about twenty-five additional sites throughout the basin during cycle 1. These samples were analyzed for trace metals, pesticides, and organic compounds.

Special studies during cycle 1 included: a comparison of shallow ground water chemistry in agricultural

areas with varying permeability; ground water flow path investigation of agricultural chemical transport; an assessment of biological communities in benchmark streams in agricultural areas; assessments of high- and low-flow chemical conditions; a study to determine the representativeness of the BFS; an investigation of ground water surface water interactions at the end of a flow path; and two studies comparing results obtained using a variety of chemical and biological sampling methods.

Low-intensity phase samples were collected monthly at 3 of the BFS for major ions, nutrients, organic contaminants, trace elements, suspended sediments, and pesticides.

Forty-seven reports were prepared to describe the results of the cycle one investigations.

## **PLANS CYCLE 2 (2001–2010)**

During cycle 2, trends sampling will include sampling at 4 of the BFS, now termed trends sites, for the same list of constituents and at a similar frequency as analyzed for during cycle 1. The Cambrian-Ordovician aquifer wells and the highly permeable shallow ground-water wells in agricultural areas will be re-sampled in 2002 for the same set of constituents as sampled during cycle 1. The entire study unit extent of the glacial aquifer will be sampled during 2003 for the same list of constituents as sampled at ground water sites during cycle 1. One or two lake cores will be collected to determine deposition history of trace elements and organic compounds using age dating techniques. Occurrence and distribution samples will be collected for total mercury in sediment, tissue and the water column at 8 surface water sites during 2002.

Two topical studies are planned for 2003 and 2004:

(1) The urban land use gradient study will assess the impacts of urbanization on the health of aquatic biota in the Milwaukee and lower Fox River urbanized area. The study will focus on assessing the health of watersheds with urbanized land use in the 10–30 percent range. Stream chemical, biological, and physical parameters will be measured and assessed against a calculated urban index.

(2) The Mercury topical study will assess the bio-accumulation of mercury in game-fish species. Total Mercury will be determined in axial muscle tissue, composited from 6–10 individuals taken at the same site. Axial muscle is the most relevant component for human health, and can be related to whole-body burdens for toxicity relevance regarding piscivorous wildlife. Sampling of Methyl Mercury and Total Mercury in water and unsieved streambed sediment at the fish sampling sites will yield useful data regarding exposure of the fish



to Mercury. Instantaneous Methyl Mercury data from the water and sediment samples will help indicate the relative potential of a watershed to convert inorganic mercury to Methyl Mercury, a critical step in mercury bioaccumulation. Methyl Mercury is more effectively biomagnified in food chains, is the predominant species of mercury in fish, and is more toxic than inorganic mercury.

## REPORTS (July 2001–July 2002)

Fitzpatrick, F., 2001, A comparison of multi-disciplinary methods for measuring physical changes in streams, AGU Monograph.

Fitzpatrick, F., 2001, Effects of riparian corridors and hydrology on agricultural stream biota, in AWRA Specialty Conference on Riparian Ecology, August, 2000.

Scudder, B., Stewart, J., 2001 Algae of agricultural benchmark streams in Eastern Wisconsin—Western Lake Michigan Drainages, USGS Water Resources Investigations Report 96-4038-A, 46 p.

Robertson, D., Saad, D., and Wieben, A., 2001, An alternative regionalization scheme for defining nutrient criteria for rivers and streams, U.S. Geological Survey Water Resources Investigations Report 01-4073, 57 p.



# UPPER ILLINOIS RIVER BASIN NATIONAL WATER-QUALITY ASSESSMENT (NAWQA)

**COOPERATOR:**

U.S. Geological Survey,  
Reston, Virginia

**PROJECT CHIEF:**

Kevin D. Richards

**LOCATIONS:**

Upper Illinois River Basin in  
Illinois, Indiana, and Wisconsin

**PROJECT NUMBER:**

WI 17402

**PERIOD OF PROJECT:**

October 1996–Continuing

**PROBLEM**

Growing populations throughout the United States have resulted in increased development and use of our water resources. As our water resources become stressed, decisions on how to effectively utilize and manage these resources will need to be made. These decisions must be based on accurate assessments of the quality of the water resource and the factors affecting its use.

**OBJECTIVE**

The long-term goals of the NAWQA project are to determine the water quality of the streams and aquifers in the Upper Illinois River Basin (UIRB), determine the presence or absence of any trends in the water quality, and provide an understanding of the link between natural and anthropogenic factors and observed water quality. Specific goals are to: (1) determine the occurrence and spatial distribution of a broad array of water-quality constituents in ground and surface water and streambed sediments, (2) determine the occurrence of contaminants in selected target taxa, (3) evaluate the aquatic habitat and community structure of streams in the study unit, (4) assess the effects of urbanization on surface-

water quality in selected stream reaches, (5) evaluate the sources and transport of selected hydrophilic compounds in agricultural settings, and (6) assess the influence of land use on shallow ground-water quality in selected land-use settings.

**APPROACH**

The foundation of the study approach is based upon identifying relatively homogeneous areas of specific land-use and environmental characteristics. Identification of these areas was accomplished by overlaying digital coverages of land use and various environmental variables using a geographic information system (GIS). Sampling sites completely contained in these relatively homogeneous areas (indicator sites) were incorporated into a nested design of surface-water, streambed sediment, and biological sampling. The sampling strategy consists of a retrospective analysis of available water-quality data (1997–1999), followed by a high (1999–2001) and then a low-phase (2002–2006) data-collection effort. Monitoring of basic fixed sites (BFS) in selected areas (indicator sites), as well as downstream sites draining heterogeneous land uses and environmental characteristics (integrator sites), are being conducted. These sites will be sampled monthly and

augmented with event-related samples. A subset of these sites will be extensively sampled for pesticides and volatile organic compounds. Pesticide samples will be collected approximately biweekly during the early to mid-summer period and less frequently during the rest of the year. Volatile organic compound samples will be collected weekly during the winter and less frequently during the rest of the year. Other program components include an urban gradient study to evaluate the relation between community (fish, algae, and invertebrates), habitat structure, land-use practices, and environmental factors. Ground-water studies include a study-unit survey and two land-use studies.

The land-use survey studies the effects of land use on ground-water quality through sampling in specific relatively homogeneous areas (1999 and 2000). A study unit survey provides an indication of water-quality conditions of the major aquifer (Silurian-Devonian) in the study unit.

### **PROGRESS (July 2001 to June 2002)**

The GIS coverages will continue to be compiled and archived including: labeling the clustered Landsat data, wetlands data from the WISCLand inventory, Natural Resource Inventory, Toxic Release Inventory, etc. Data archiving for data collected during the HIP (1999–2001) continues.

Land-use gradient special study—Open File Data report was approved for publication. The retrospective journal article “Urbanization influences on aquatic communities in northeastern Illinois streams” was prepared, undergone colleague review and the comments were incorporated. Data analysis and interpretation are ongoing for the proposed journal article “Ecological responses to physical and chemical changes related to urbanization in the Upper Illinois River Basin.”

### **PLANS (July 2002 to June 2003)**

Three surface-water trend sites will be monitored for continuous flow and sampled 8 to 10 times a year for field parameters, pesticides, nutrients, selected ions, and suspended sediment.

Data from the high-intensity phase will continue to be analyzed and the results of analyses compiled in reports.

Ecological sampling will be conducted at the surface water trend sites in August 2002.

A number of publications are planned related to the ecological data collected and the land use gradient study.

### **REPORTS**

Sullivan, D.J., 2000, Nutrients and suspended solids in surface waters of the Upper Illinois River Basin in Illinois, Indiana, and Wisconsin, 1978–97: U.S. Geological Survey Water-Resources Investigations Report 99–4275, 57 p.

Fitzpatrick, F.A., Colman, J.A., and Arnold, T.L., 1998, Surface water-quality assessment of the Upper Illinois River Basin in Illinois, Indiana, and Wisconsin: spatial distribution of geochemicals in the fine fraction of streambed sediment, 1987: U.S. Geological Survey Water-Resources Investigations Report 98–4109, 89 p.

Sullivan, D.J., Stinson, T.W., Crawford, J.K., and Schmidt, A.R., 1998, Surface-water quality assessment of the Upper Illinois River Basin in Illinois, Indiana, and Wisconsin—Pesticides and Other Synthetic Organic Compounds in Water, Sediment, and Biota, 1975–90: U.S. Geological Survey Water-Resources Investigations Report 96–4135, 131 p.



*Fish shocking on the Des Plaines River at Russell, Illinois (USGS Station ID 05527800).*

# NATIONAL WATER-QUALITY ASSESSMENT (NAWQA) SPECIAL

**COOPERATOR:**

U.S. Geological Survey,  
Reston, Virginia

**PROJECT CHIEF:**

Charles A. Peters

**LOCATIONS:**

Support of NAWQA National  
Leadership and Synthesis Teams

**PROJECT NUMBER:**

WI 17403

**PERIOD OF PROJECT:**

October 1996–Continuing

and ground water?, (2) How are these conditions changing over time?, and (3) How do natural features and human activities affect these conditions?

**APPROACH**

Western Lake Michigan (WMIC) NAWQA Study Unit scientists cover a range of disciplines, including hydrology, geology, geomorphology, biology, chemistry, geographic information systems, database management, and statistics. WMIC Scientists have provided support to the NAWQA National Leadership and Synthesis Teams (NLT and NST) on a variety of topics that include: (1) Ground-water sampling protocol development, (2) Development of habitat sampling protocol, (3) Instruction at NAWQA Training And Methods Shakedown (TAMS), (4) Membership on the National Data Synthesis Team (DST), (5) Leading the NAWQA study unit archive process, and (6) Work with the Ecological Synthesis Team (EST) on the development of a biological database (BioTDB).

**PROBLEM**

Growing populations throughout the United States have resulted in increased development and use of our water resources. As our water resources become stressed, decisions on how to effectively utilize and manage these resources will need to be made. These decisions must be based on accurate assessments of the quality of the water resource and the factors affecting its use.

**OBJECTIVE**

Since 1991, USGS scientists with the NAWQA program have been collecting and analyzing data and information in more than 50 major river basins and aquifers across the Nation. The goal is to develop long-term consistent and comparable information on streams, ground water, and aquatic ecosystems to support sound management and policy decisions. The NAWQA program is designed to answer these questions: (1) What is the condition of our Nation's streams

**PROGRESS (July 2001 to June 2002)**

Participated in archive reviews of the Long Island Coastal, Puget Sound and Upper Mississippi NAWQA study units. Study unit database manager serves as the Northeast Region study unit representative to the DST and participate in meetings and conference calls. WMIC study unit biologist revised the users manual for the biological database that is available on the Ecological Synthesis Teams website. Instructed habitat protocol at TAMS training in April to NAWQA Cycle II study unit biologists and technicians. Revised the groundwater protocol for colleague review.

**PLANS (July 2002 to June 2003)**

Incorporate review comments to the groundwater protocol and complete final draft. Continue involvement with the DST and conduct an archive review of a Southeastern Region NAWQA study unit. Maintain and update the NAWQA habitat protocol. Assist the EST with analysis and synthesis of NAWQA Cycle I Urban Land Use Gradient Study data.



# DEMONSTRATION OF SUBMERGED VANES, FISH CREEK

**COOPERATORS:**

Wisconsin Department of Natural  
Resources  
Bayfield County  
U.S. Fish and Wildlife Service

**PROJECT CHIEF:**

Faith A. Fitzpatrick

**LOCATION:**

Bayfield County

**PROJECT NUMBER:**

WI 19300

**PERIOD OF PROJECT:**

July 2000 to September 2003

**PROBLEM**

North Fish Creek has accelerated erosion and sedimentation problems that have potentially negatively impacted a highly valued fishery resource. Previous USGS studies identified bluff erosion along the upper main stem as the major source of sediment to downstream reaches. Bioremediation techniques for bluff stabilization were attempted but failed. Erosion control techniques are limited because of the remoteness of the site and lack of access.

**OBJECTIVES**

The main goal of this study is to demonstrate the ability of an in-stream restoration technique (submerged vanes on the channel bed) to reduce bluff erosion along a flashy, high-energy stream, and ultimately reduce subsequent sedimentation problems in North Fish Creek and potentially Lake Superior. Reducing sediment loads of Lake Superior tributaries is important not only for protecting or restoring aquatic habitat, but also for dredging issues.

**APPROACH**

Submerged vanes were installed in the channel bed at two eroding bluff sites along the upper main stem of North Fish Creek in the summer of 2000 and 2001. The number, size, and layout of the vanes depend on the channel morphology, velocity, and depth at a meander bend. Typically, about 15 vanes are installed in groups of one to three. Vanes modify the secondary flows that cause erosion along the toe of a bank in a meander bend. Vanes stabilize a channel reach without inducing changes upstream or downstream of that reach. The vanes are not visible in time (they become buried by depositing sediments yet remain effective), and aid the stream in doing the work by redistributing the flow energy to produce a more uniform cross-section without an appreciable increase in the energy loss through the reach.

Monitoring the success of the study will be conducted through surveys of the bluff face, streamflow, and channel conditions before, during, and after installation of the submerged vanes. The bluff and channel will be resurveyed after flood events. The bluff surveys

will be used to compare pre- and post-installation bluff retreat rates. Channel cross section surveys will be conducted at the site and in upstream and downstream locations to quantify changes in the shape and location of the channel. A streamflow-gaging station will be reactivated downstream of the site to properly quantify flood magnitudes experienced during the demonstration. Stage recorders will be installed at the bluff sites.

### **PROGRESS (July 2001 to June 2002)**

Submerged vanes were installed at the second site. Bluff and channel surveys were conducted at both sites.

Streamflow was monitored at a gage downstream of both sites. Stage data were collected at both bluff sites. A master's thesis was published on installation and monitoring of vanes at the first site.

### **PLANS (July 2002 to June 2003)**

Bluff and channel surveys will be conducted at both sites following major floods. Stage data will be collected at both sites. Streamflow data will be collected at a USGS gaging station downstream of both sites.



*Placement of submerged vanes (white) at bluff site 1, Fish Creek (photo taken in 2001).*

# HYDROLOGIC LITERATURE SEARCH AND DIGITAL DATA COMPILATION OF CAMP WISMER AND PROPOSED HYDROLOGIC INVESTIGATION OF POTENTIAL SOURCE AREAS OF CONTAMINATION AT CAMP WISMER

**COOPERATOR:**

Wisconsin National Guard

**PROJECT CHIEF:**

Bernard N. Lenz

**LOCATION:**

Camp Wismer, near Hayward

**PROJECT NUMBER:**

WI 19500

**PERIOD OF PROJECT:**

October 2001–February 2002

**PROBLEM**

Camp Wismer covers nearly 3,600 acres in northwest Wisconsin about 9 miles northwest of the city of Hayward. Camp Wismer has been the site of training for the Wisconsin Army National Guard (WI-ARNG) since May 1986. The area is largely wooded and interlaced with unpaved forest roads. The majority of the activities of the WI-ARNG occur in the 124.4 acres owned by the U. S. Government on the western most portions of Camp Wismer and specifically within 4 areas. These include a 6.1-acre firing range, a 13.4-acre vehicle maneuvering area, a 1-acre fenced engineering exercises (Bailey bridges training) area, and a 0.3-acre sand pit quarry. The eastern 3,360 acres of Camp Wismer is leased from Sawyer County and used only for field orientation exercises. Prior to it being designated a military installation, parts of Camp Wismer were once occupied by small farms and homesteads, many of which have reverted back to forest.

**OBJECTIVE**

The National Guard Bureau (NGB) has requested the Water Resources offices of the USGS define and document the hydrology, hydrogeology, and the pres-

ence or absence of contamination in the ground water and surface water on military installations. Phase I of the project is to gather all available information on the water resources of the Camp and prepare a phase II study to fill in the gaps of missing data.

**APPROACH**

Available hydrologic data on Camp Wismer will be assembled and include GIS coverages, Well Log data, USGS and EPA database retrievals, atmospheric deposition data, and the Wisconsin State Historical Land Survey data. Phase I results are presented in letter along with a CD containing the hydrologic data and all GIS coverages. A proposal to perform work to fill in missing or incomplete hydrologic data on the installation was prepared.

**PROGRESS (July 2001 to June 2002)**

Project complete.

**PLANS (July 2002 to June 2003)**

Possible watertable ground-water monitoring in water year 2003 to fill in holes in data.



# NATIONAL ENVIRONMENTAL METHODS INDEX

**COOPERATOR:**

U.S. Environmental Protection  
Agency

**PROJECT CHIEF:**

Daniel J. Sullivan

**LOCATION:**

United States

**PROJECT NUMBER:**

WI 21006

**PERIOD OF PROJECT:**

October 1999–Continuing

**PROBLEM**

The National Environmental Methods Index (NEMI) is a project of the National Methods and Data Comparability Board, a partnership of water-quality experts from Federal agencies, States, Tribes, municipalities, industry, and private organizations. The Board, and its parent organization the National Water Quality Monitoring Council (NWQMC) were chartered under the Federal Advisory Committee Act (FACA) in 1997 as multi-agency committees to develop a voluntary, integrated, and nationwide water quality monitoring strategy. The Board's goal is to identify, examine, and recommend water-quality monitoring approaches that facilitate collaboration amongst all data-gathering organizations and yield comparable data and assessment results. NEMI allows rapid communication and comparison of methods, thus ensuring that the consideration of analytical methods is a more active part of the planning and implementation of programs.

**OBJECTIVE**

The selection of analytical methods is a critical component of the planning process for environmental monitoring programs. With NEMI you can compare methods at a glance and find the method that best meets your needs. NEMI also allows you to use and share monitoring data among different agencies, using different methods at different times.

**APPROACH**

NEMI is a clearinghouse of environmental monitoring methods. The NEMI database contains method summaries of field and lab protocols for regulatory and non-regulatory water quality analyses. It is searchable over the World Wide Web, providing you with up-to-date methods information through a standard Internet connection and browser.

## **PROGRESS**

To date, NEMI contains more than 650 chemical, immunoassay, physical, microbiological and radio-chemical methods. NEMI's data fields include detection levels, bias, precision, and other Quality Assurance/Quality Control requirements that will enable you to document and report on data quality. You can search NEMI by: (1) Chemical/biological parameter; (2) Method source; (3) Metadata (precision, accuracy, detection level, etc.) Instrumentation; and (4) Method.

## **PLANS**

During FY2003, plans for NEMI include adding methods to the database, including methods for field collection and new technologies. The web interface will continue to be refined, allowing users quicker and easier access to data. The NEMI workgroup will continue to work with the National Methods and Data Comparability Board to further enhance NEMI's usefulness to the environmental monitoring community.

# NEOPIT MILL POND SEDIMENTATION AND SEDIMENT CHEMISTRY STUDY

**COOPERATOR:**

Menominee Indian Tribe of  
Wisconsin

**PROJECT CHIEF:**

Faith A. Fitzpatrick

**LOCATION:**

Neopit, Menominee Indian  
Reservation

**PROJECT NUMBER:**

WI 21101

**PERIOD OF PROJECT:**

February 2001 to June 2003

**PROBLEM**

The dam at the Neopit Mill Pond, Neopit, Wisconsin, Menominee Reservation, may be removed. The Menominee Tribe needs information on the volume, texture, and chemistry of sediment stored behind the dam. The pre-dam channel of the West Branch Wolf River is not known. This information is needed for sound decision-making involving the potential dam removal and subsequent stream restoration.

**OBJECTIVE**

The project objectives are to: (1) establish pre-dam topography and volume of sediment in the Mill Pond, (2) define the texture, and organic and trace element chemistry of the post-dam sediment in the Neopit Mill Pond, and (3) identify the pre-dam channel of the West Branch of the Wolf River.

**APPROACH**

Water depth and soft sediment depth will be measured by use of sounding poles at approximately 13 cross sections. Land surveys of banks and islands bisected by cross sections will be conducted. The USGS will provide training for personnel from Environmental

Services, Menominee Tribe, to conduct the soundings. Approximately one to three cores will be collected per cross section with a piston corer and geoprobe. Selected cores will be subsampled for analysis of particle size,  $^{137}\text{Cs}$  dating, water content, trace elements, and organic contaminants. Samples will be submitted to the USGS National Water-Quality Laboratory for analyses of trace elements, organic contaminants, and  $^{137}\text{Cs}$  dating. Particle size samples will be submitted to the USGS particle size laboratory in Iowa. Water content will be measured at the USGS in Middleton, Wisconsin. Approximately 10 percent of the samples will be submitted for quality assurance. Results will be published as a USGS Open-File Report or Water-Resources Investigations Report.

**PROGRESS (July 2001 to June 2002)**

Remaining samples were submitted for analysis of trace elements, organic chemicals, and radiometric age dating. Menominee Tribe Personnel completed bathymetric surveys of the millpond. Data analysis and report writing commenced.

**PLANS (July 2002 to June 2003)**

Finish data analysis and report writing.

# ST. CROIX NATIONAL SCENIC RIVERWAY—NUTRIENT AND SEDIMENT LOADING AND LONG-TERM WATER-QUALITY MONITORING

**COOPERATORS:**

National Park Service Joint Water  
Quality Commission of Danbury;  
St. Croix Chippewa Indians  
of Wisconsin

**PROJECT CHIEF:**

Bernard N. Lenz

**LOCATION:**

St. Croix National Scenic  
Riverway

**PROJECT NUMBERS:**

WI 21202, 00301

**PERIOD OF PROJECT:**

October 1998 to September 2001

**PROBLEM**

The St. Croix National Scenic Riverway (NSR) contains more than 60 state and federally listed endangered and threatened species, indicating that it provides one of the few remaining relatively well-preserved and biologically diverse aquatic environments in the region. The NSR has a very active management and scientific community and a rich research history. Although the water quality is generally considered to be good in the Upper St. Croix and Namekagon Rivers, activities in the tributaries and their watersheds are affecting the overall health of the St. Croix NSR. In the Lower St. Croix River, including Lake St. Croix, nutrient levels are elevated. Recreational and developmental pressures are intensifying in the watershed. Recreational use has doubled since 1973 to nearly one million visitors yearly. Due to its proximity to the Minneapolis/St. Paul metropolitan area, the Riverway will continue to experience increased use and developmental pressure from population growth in the counties adjacent to the Riverway.

**OBJECTIVE**

The objectives of this project are to provide consistent, long-term water-quality monitoring at key sites on the St. Croix River and develop a long-term database to use to detect changes and protect the water resources of the St. Croix River.

**APPROACH**

21202—USGS/Joint Water Quality Commission of Danbury and St. Croix Chippewa Indians of Wisconsin—From October 2000 through September 2001, the USGS continuously monitored streamflow, and collected sediment and nutrient samples at the St. Croix River near Danbury. Historical long-term USGS water-quality data from the St. Croix River at Danbury will be summarized and compared to recent water-quality data and be presented in a fact sheet.

00301—USGS/NPS—Water quality data from the St. Croix River at St. Croix Falls will be summarized

and compared to recent water-quality data and be presented in the fact sheet. Trends in streamflow and water quality of the St. Croix River at Danbury and at St. Croix Falls will be summarized and presented in the fact sheet.

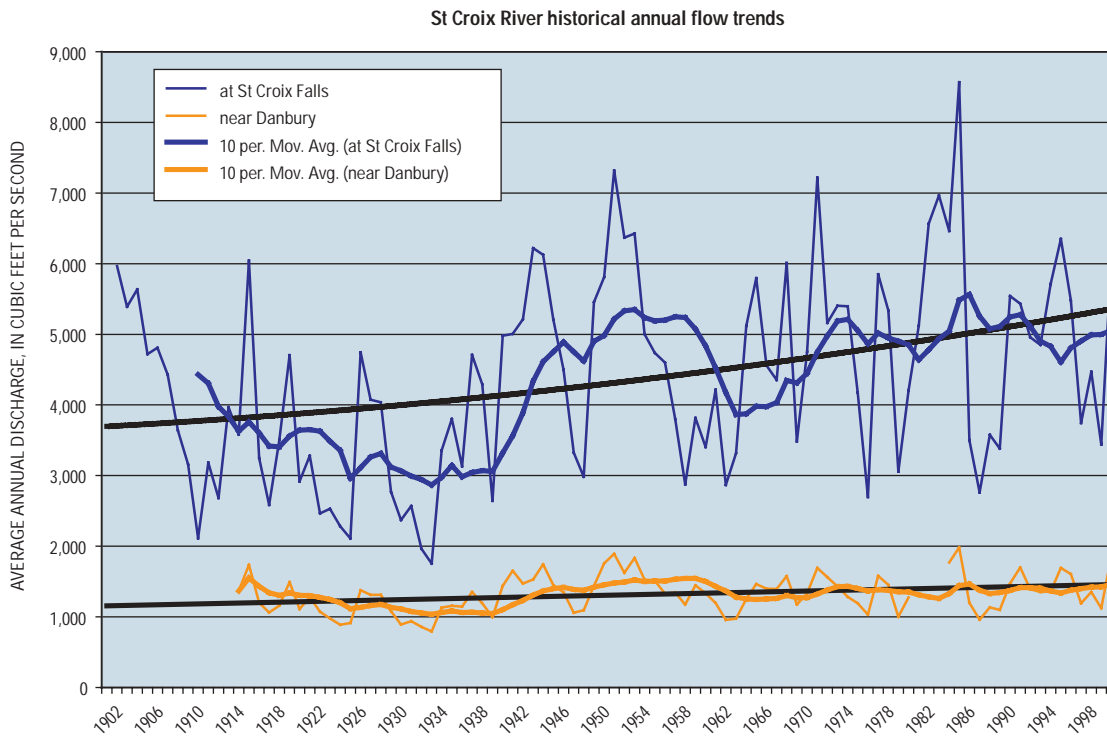
### PROGRESS (July 2001 to June 2002)

Continuous streamflow monitoring and monthly water-quality sampling was completed in September 2001. Historical data has been gathered and analysis is ongoing. Annual progress reports are being supplied to

the NPS throughout the project. Many new partnerships with scientists and agencies working in the St. Croix Basin have been developed. A heightened awareness of nutrient and sediment loading and these new relationships should lead to continued scientific interest and study in the St. Croix Scenic Riverway.

### PLANS (July 2002 to December 2002)

A USGS Fact Sheet will be produced that relates historical long-term water quality and flow to recent water quality and flows.



Trends in annual average streamflow for the St. Croix River at St. Croix Falls and near Danbury, Wisconsin.

# WHITTLESEY CREEK HYDROLOGY STUDY

**COOPERATOR:**

Bayfield County

**PROJECT CHIEF:**

Faith A. Fitzpatrick

**LOCATION:**

Bayfield County

**PROJECT NUMBER:**

WI 21500

**PERIOD OF PROJECT:**

May 1999 to June 2003

**PROBLEM**

Whittlesey Creek is considered an Outstanding Resource Water and Valued Lake Superior Ecosystem Member. This small watershed serves as spawning ground for 35 percent of Wisconsin's coho salmon population because of its consistent base flow and good water quality. However, like many Wisconsin tributaries to Lake Superior, aquatic habitat in Whittlesey Creek is possibly degraded because of accelerated runoff and associated sedimentation problems. In addition, the sources for the abundant baseflow in Whittlesey Creek are not very well understood. Recently, the mouth of Whittlesey Creek has been proposed as a National refuge for the re-establishment of Coaster Brook Trout. A hydrological analysis of streamflow in Whittlesey Creek is needed to identify potential present and future land-cover impacts on baseflow and flooding characteristics of the creek.

**OBJECTIVE**

Objectives are to: (1) quantify current streamflow characteristics for Whittlesey Creek floods, base flow,

and seasonal fluctuations, (2) quantify contributions of runoff and ground water to streamflow, (3) identify ground-water recharge and discharge areas for Whittlesey Creek (identify contributions from glacial deposits vs. sandstone bedrock aquifers), (4) identify pre-settlement hydrologic conditions, (5) quantify how current land-cover characteristics affect flood and base-flow characteristics, (6) predict how future changes in land cover affect floods and base flow in Whittlesey Creek and (7) identify areas of the basin that contribute the most to flooding problems.

**APPROACH**

This study used an event-based rainfall/runoff model (SWAT) and two ground-water models (MODFLOW; GFLOW) to quantify base flow and flooding characteristics of Whittlesey Creek. Hydrologic field data also was collected to help refine and calibrate the models. The proposed study started in April 1999 with installation and operation of a streamflow and rainfall gaging station near the mouth of Whittlesey Creek and a survey of base-flow conditions (seepage run). In

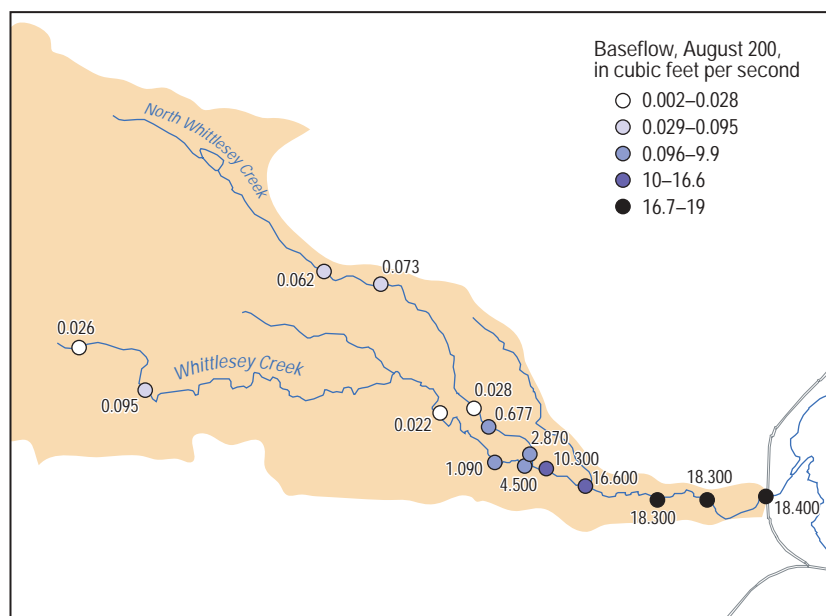
FY 2000–2001, additional field data was collected for the rainfall/runoff and ground-water models, GIS data for the rainfall/runoff model was gathered, and the models were compiled and calibrated. In FY 2002, a report on the modeling results will be written and published.

## PROGRESS (July 2001 to June 2002)

Rainfall/runoff and ground-water models were completed. Results were presented to cooperator. A draft report was written.

## PLANS (July 2002 to June 2003)

Publish report.



Whittlesey Creek base-flow measurements, August 2000.



# HISTORICAL ECOSYSTEM RECONSTRUCTION AND POTENTIAL IDENTIFICATION OF EFFECTS OF PAST ECOSYSTEM PERTURBATIONS IN LAC COURTE OREILLES

**COOPERATORS:**

Lac Courte Oreilles Tribe;  
Wisconsin Department of  
Agriculture, Trade, and  
Consumer Protection

**PROJECT CHIEF:**

Faith A. Fitzpatrick

**LOCATION:**

Lac Courte Oreilles, Sawyer County

**PROJECT NUMBER:**

WI 21700

**PERIOD OF PROJECT:**

October 1999 to September 2001

**PROBLEM**

There has been a potential increase in nutrient inputs and enhanced eutrophication in Musky Bay, Lac Courte Oreilles, Wisconsin in the last few decades. Historically, the Bay contained wild rice beds and was a major spawning ground for muskellunge, which make up a large portion of the Lac Courte Oreilles Tribe's diet. The Lac Courte Oreilles Tribe is interested in determining changes in historical nutrient inputs to Musky Bay, determining the source of the nutrients, and comparing these findings to historical nutrient inputs in other parts of Lac Courte Oreilles.

**OBJECTIVE**

The main objective is to reconstruct the ecosystem history of Musky Bay and an additional site within Lac Courte Oreilles with special emphasis on possible effects of cranberry farming and shoreline development using the sediment record. The principal focus is on the nutrient history (input and burial rates) that reflects management practices and possible watershed degradation. Another focus is to search for possible cranberry farming signatures including sulfur, uranium, and potassium associated with fertilizers, and copper associated with pesticides.

**APPROACH**

Several cores from Musky Bay and additional sites on the lake were collected in 1999 and 2001. Dates and sedimentation rates were calculated for 20 increments in the Musky Bay core (15 increments from an additional core) from analyses of  $^{210}\text{Pb}$ ,  $^{226}\text{Ra}$ , and  $^{137}\text{Cs}$ . Total organic carbon and nutrient (nitrogen, phosphorus, biogenic silica) input and burial rates were calculated from dated sediment by combining measured concentrations of these nutrients and mass sediment accumulation rates. Diatom and pollen assemblages were examined by the Wisconsin Department of Natural Resources. Biogenic silica profiles were used as supporting evidence for diatom reconstructions and as an indicator of species shifts (largely from diatoms to non-siliceous algae) in response to increased nutrient inputs. Forty-two geochemical parameters were measured.

**PROGRESS (July 2001 to June 2002)**

Lake sediment and soil samples were collected from Lac Courte Oreilles and surrounding areas for additional geochemical analysis. The report was written and submitted for review.

**PLANS (July 2002 to June 2003)**

Publish a Water-Resources Investigations Report and submit paired journal articles for publication.

# MILWAUKEE METROPOLITAN SEWERAGE DISTRICT CORRIDOR STUDY

**COOPERATOR:**

Milwaukee Metropolitan  
Sewerage District

**PROJECT CHIEF:**

Morgan A. Schneider

**LOCATION:**

Milwaukee County and parts of  
Waukesha, Washington,  
Ozaukee, and Racine Counties

**PROJECT NUMBER:**

WI 22500

**PERIOD OF PROJECT:**

February 2001–Continuing

**PROBLEM**

The Milwaukee Metropolitan Sewerage District (MMSD) has a watercourse improvement program that is designed to integrate flood control with habitat and water-quality protection and enhancement. The MMSD Corridor Study will compile and collect historical and existing hydrologic, geographic, physical, biological, and chemical data for perennial streams and selected intermittent watercourses and their adjacent corridors within the MMSD planning area. The data will be used to help identify existing waterway limitations, and to evaluate and forecast the potential impacts or improvements from watercourse modifications. The MMSD Corridor Study is a cooperative effort between many local, state, and federal agencies that are represented on the Steering Committee. The Steering Committee is made up of members from the Milwaukee Metropolitan Sewerage District, the U.S. Geological Survey (USGS), the Wisconsin Department of Natural Resources (WDNR), the Southeastern Wisconsin Regional Planning Commission (SEWRPC), UW-Milwaukee, Mar-

quette University, Wisconsin Lutheran College, and others.

**OBJECTIVE**

The primary objectives of the MMSD Corridor study include: (1) evaluating historic impacts and forecasting potential impacts of planned MMSD projects, (2) creating a comprehensive inventory of corridor conditions, (3) establishing a baseline assessment of existing watercourse and corridor conditions, (4) determining the existing and potential water-use objectives for watercourse reaches, (5) following up on flood control, habitat and water-quality improvement or protection projects to verify anticipated results, evaluate current technologies, and identify adjustments for future projects, and (6) providing long-term surveillance of stream and corridor conditions to monitor project impacts, track changes in impaired and unimpaired reaches, provide additional inventory information, and allow early detection of newly impaired reaches.

## APPROACH

There is a three-phase approach to the MMSD Corridor study. Phase I will include the development of a data warehouse and evaluation of analytical procedures. A data warehouse will be compiled from different data sets with the purpose of assembling data from within the corridor study area. The assembled data will then be analyzed to summarize existing conditions and identify data gaps and future data needs. Phase II will consist of a baseline inventory of water-quality conditions in the MMSD study area. An intensive data-collection and analysis effort will be made to fill in data gaps and update historic data to define the existing characteristics of the watercourses and corridors and serve as the basis for future impact evaluations and trend analyses. Phase III will be the development of a long-term inventory of water-quality data and maintenance of the data warehouse. The data collected as part of field activities and the data maintained in the data warehouse will be used to assess future impacts, measure the benefits of watercourse modifications and other watershed management efforts, and detect new watercourse concerns or impairments.

## PROGRESS (July 2001 to June 2002)

Ongoing Steering Committee meetings keep members informed of project progress and provide a forum for feedback.

Data sets from MMSD, USGS, and USEPA have been incorporated into the data warehouse. Data sets

from the WDNR have been compiled and prepared for loading into the data warehouse. Some hard copy data from WDNR has been converted into electronic format in order to load it into the data warehouse.

A literature review of studies and research reports in the MMSD study area has been completed, the results of which will be included in a report summarizing data in the data warehouse.

## PLANS (July 2002 to June 2003)

Incorporation of more data sets including data from WDNR and various universities will continue.

“Canned queries” created with the query tool Oracle Discoverer for use by the Steering Committee and other internal users over the Internet will be improved.

GIS data sets for the study area will be compiled from various agencies into a GIS library. GIS data may be used at a later time with a yet-to-be-determined spatial tool to allow users to query for data from the data warehouse from a mapping interface.

Steering Committee meetings will continue. The MMSD Corridor study was the focus of one presentation at the May 2002 National Monitoring Conference held in Madison, Wisconsin.

A report summarizing data in the data warehouse will be written in the spring of 2003.

Planning for Phase II, baseline monitoring, will begin in the spring of 2003. Sampling will begin in the late spring or summer of 2003.



*Milwaukee River at Estabrook Park, Milwaukee, Wisconsin (USGS Station ID 04087000).*

# GREAT LAKES AQUATIC GAP

**COOPERATOR:**

U.S. Geological Survey,  
Biological Resources Discipline

**PROJECT CHIEF:**

Jana S. Stewart

**LOCATION:**

Great Lakes States

**PROJECT NUMBER:**

WI 22600

**PERIOD OF PROJECT:**

September 2001 to June 2002

**PROBLEM**

An Aquatic Gap program is being proposed for the riverine systems of the Great Lakes Region including new projects in the States of Minnesota, Wisconsin, Illinois, Michigan, Indiana, and New York and integration of existing or completed projects in Ohio and Pennsylvania. A pilot study to develop a coastal component for Aquatic GAP is also being proposed for the Great Lakes Region. The Great Lakes are the largest system of freshwater on earth and provide habitat for a wide variety of aquatic organisms unique to these systems. The aquatic biodiversity of the region is being threatened due to increased population growth from urban expansion, more intensive agricultural practices, continued logging and coastal zone shoreline destruction.

**OBJECTIVE**

The objectives of this project are to (1) develop a multi-institutional, multi-state regional cooperative approach toward the development and use of Aquatic Gap data, (2) produce a contact list of key stakeholders and collaborators in the states of the Great Lakes Region, (3) produce a summary of existing fish and aquatic macroinvertebrate databases in the Great Lakes Region, (4) produce a summary of planned and existing thematic spatial data layers needed for Aquatic Gap for the Great Lakes Region, (5) review the Michigan Institute of Fisheries Research groundwater/surface water interaction model, (6) assess the feasibility and identify a pilot study area for conducting a coastal aquatic gap effort, and (7) develop a multi-year proposal for conducting Aquatic Gap in the Great Lakes Region.

**APPROACH**

The feasibility for conducting Aquatic Gap for both riverine and coastal systems will be assessed by summarizing the status and availability of existing data for each of the States, including fish and macroinvertebrate databases, spatial data layers related to physical characteristics of the land and in-stream habitat. An integrated approach will be developed for Aquatic Gap in the Great Lakes region in which common methods and protocols will be established and results will be comparable across the landscape. A list of stakeholders in the region will be developed and contacted for their input into this effort.

**PROGRESS (September 2001 to June 2002)**

A contact list of stakeholders was developed and stakeholders meetings were held in Michigan and Wisconsin. Existing aquatic biological databases and thematic spatial data layers were summarized for the Great Lakes States and the feasibility for conducting Aquatic Gap in the Great Lakes States was assessed. A multi-year proposal for conducting Aquatic Gap in the Great Lakes States and developing a Coastal Aquatic Gap pilot was developed.

**PLANS (June 2002 to May 2003)**

Ecological stream classifications will be developed for the states of Michigan and Wisconsin and aquatic biological databases will be developed for Michigan, Wisconsin, and New York. Projects will be conducted as individual State projects under the umbrella of the Great Lakes Aquatic Gap project.

# KALAMAZOO RIVER GEOMORPHOLOGY STUDY

**COOPERATORS:**

Michigan Department of Environmental Quality;  
U.S. Environmental Protection Agency

**PROJECT CHIEF:**

Faith A. Fitzpatrick

**LOCATION:**

Allegan County, Michigan

**PROJECT NUMBER:**

WI 22700

**PERIOD OF PROJECT:**

October 2001 to March 2003

**PROBLEM**

The Kalamazoo River has been designated as a Federal Superfund Site from the city of Kalamazoo to its mouth at Lake Michigan. Fluvial deposits from a variety of environments related to the Kalamazoo River contain elevated concentrations of polychlorinated biphenyls (PCBs) from paper-mill carbonless copy paper production. There are four dams on the Kalamazoo River between Plainwell and Allegan. Pool levels behind the dams were lowered prior to state ownership in the late 1960s, exposing previously inundated sediment with elevated PCB concentrations. Dam superstructures were removed (leaving a sill) in 1987. PCB-laden sediment continued to be transported and deposited downstream of each dam as a new channel cut through the previously impounded reach. The USGS is currently collecting suspended sediment, bedload sediment data, and channel cross section data that will be used in a transport model of sediment movement simulating the effects of catastrophic removal of the dams. Rather than duplicating costs and field efforts that have already been completed, this study would use or build upon field data, GIS data,

and numerical models applied by the USGS, other agencies, and consultants. Preliminary observations indicate that the previously inundated surfaces fall into at least two elevation categories. One appears to currently be functioning as a flood plain and the other, somewhat lower surface, appears to be functioning as a wetland. This has caused some definitional complexity in the cleanup criteria applicable to the exposed sediment. The upland soil category doesn't seem to fit because both surfaces are frequently inundated, increasing the risk of exposure of high PCB concentrations for a variety of aquatic life.

**OBJECTIVE**

The objectives of the study are to: (1) qualitatively describe the regional hydrologic conditions of the Kalamazoo River compared to other large Great Lakes tributaries in Michigan; (2) construct the longitudinal profiles and gradients for the Kalamazoo River from its headwaters to the mouth for conditions (a) without dams, (b) with dams in full operation, and (c) with dam sills removed; (3) identify reaches of the Kalamazoo



River prone to lateral migration or avulsion circa (a) 1827 (b) 1938, (c) 1960, and (d) 2000 from Kalamazoo/Calhoun County line to its mouth at Lake Michigan; (4) measure bank stability for the Plainwell to Trowbridge Dam reach; (5) estimate channel development and stability for current conditions; (6) determine pre-dam channel elevation and planform dimensions; (7) determine permanence of engineered banks under current conditions, and (8) model bank and channel stability for the Plainwell to Otsego City Dam reach under scenarios of (a) catastrophic failure, (b) controlled removal with natural river channelization, and (c) controlled removal with designed channelization and/or re-routing.

## **APPROACH**

The approach for this study involves field data collection and modeling by the USGS offices in Michigan and Wisconsin, as well as technical support from the U.S. Department of Agriculture, Agricultural Research Service. The approach includes: (1) conducting a literature review and describing the general watershed characteristics; (2) reviewing historical geomorphic data for the Kalamazoo River and determine if data are detailed enough to reconstruct pre-dam channel shape, substrate, and bed elevation; (3) quantifying the longitudinal profile of the Kalamazoo River from headwaters to its mouth (a) without dams, (b) with dams in full oper-

ation, and (c) with dam sills removed and identifying reaches with slope changes and investigate possible causes for changes (anthropogenic/dams vs. geologic setting, historical relations with pre-glacial drainage); (4) determining channel planform/location for the Kalamazoo River from Kalamazoo/Calhoun County line to its mouth for the years 1827, 1938, 1960, and 2000; (5) evaluating digital representation of previously inundated surfaces for the Plainwell to Allegan reach of the Kalamazoo; (6) modeling bank stability under current conditions for the Plainwell to Trowbridge Dam reach; (7) conducting evaluation of channel stability under three scenarios for the Plainwell and possibly the Otsego City dam reach; and (8) writing a USGS Water Resources Investigations Report that contains all results.

## **PROGRESS (October 2001 to June 2002)**

A literature review was conducted. A longitudinal profile was constructed. Previously collected cores and cross section data were examined. Bank stability modeling was begun. Bank erosion measurements were collected in the field.

## **PLANS (July 2002 to June 2003)**

Finish collecting data and run models. Write report.

# BAD RIVER GEOMORPHOLOGY/STREAMFLOW TRENDS

**COOPERATOR:**

Bad River Tribe

**PROJECT CHIEF:**

Faith A. Fitzpatrick

**LOCATION:**

Bad River Reservation;  
Ashland County

**PROJECT NUMBER:**

WI 23000

**PERIOD OF PROJECT:**

May 2001 to September 2002

**PROBLEM**

A historical perspective of changes in the geomorphic and hydrologic conditions of the Bad River watershed is needed. Previous sediment load studies conducted by the USGS identified the Bad River as having the highest sediment load of all tributaries to Lake Superior. A large, highly-valued coastal wetland complex exists at the mouth of the river. It is not known how sediment inputs affect aquatic conditions in the wetland.

**OBJECTIVE**

The main objectives of this study are to understand the historical and modern impacts of land cover on streamflow, sedimentation and erosion rates, and geomorphic conditions in the Bad River and some of its key tributaries.

**APPROACH**

The approach involves four aspects for the reconnaissance phase of the study: (1) gather available GIS

coverages and define watershed characteristics of major subbasins of the Bad River, (2) examine the streamflow record at U.S. Geological Survey gaging station for historical variations, (3) conduct a field reconnaissance trip to identify hot spots of erosion/sedimentation, and (4) conduct a literature search of any publications or studies done on the Bad River Basin related to streamflow, sedimentation, erosion and historical land uses.

**PROGRESS (October 2001 to June 2002)**

A field reconnaissance trip was conducted. Literature review, gathering of GIS coverages, and streamflow analysis was begun.

**PLANS (July 2002 to June 2003)**

Finish literature review, analysis of streamflow trends, and compilation of GIS coverages for the watershed. Present results to the Bad River tribe personnel.



